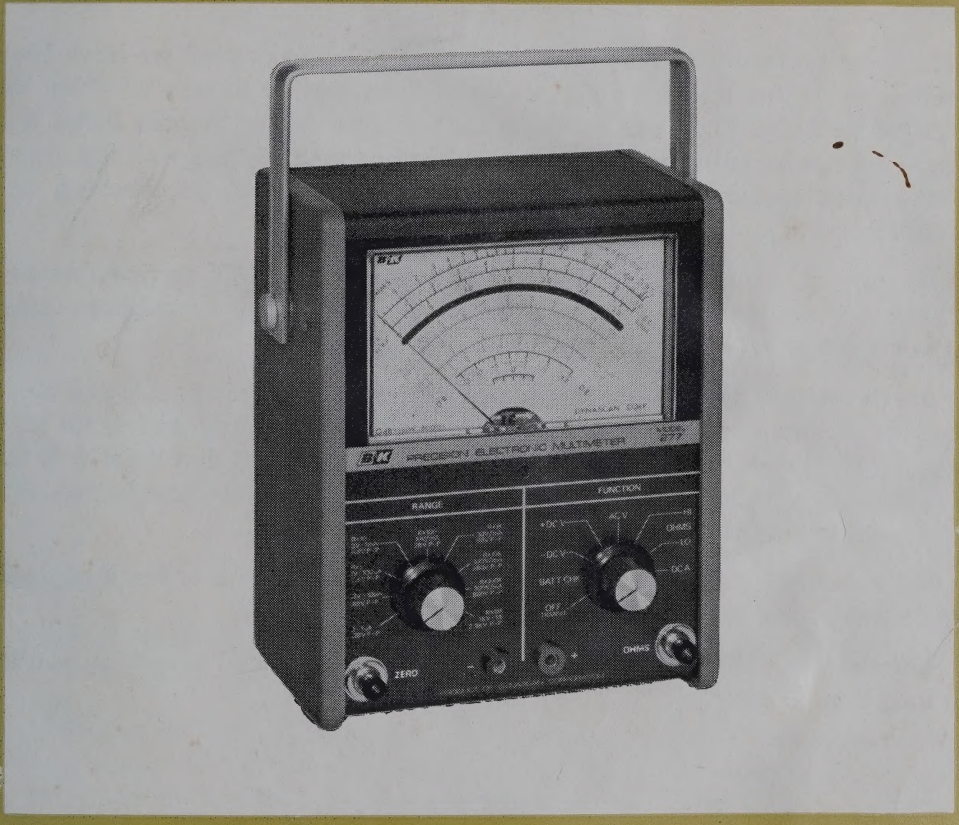
INSTRUCTION MANUAL

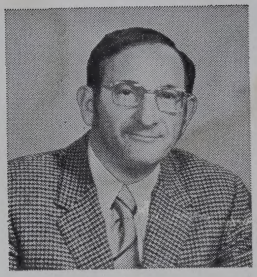
B&K Model 277

SOLID STATE ELECTRONIC MULTIMETER



B&K

Product of DYNASCAN CORPORATION
1801 West Belle Plaine Avenue, Chicago, Illinois 60613



Dear Friend:

Congratulations on your purchase of B & K—Precision Test Equipment, and welcome to the B & K family. We hope your experience with your new test equipment will make you a lifetime B & K customer.

Your instrument is backed by more than 20 years of experience in designing and manufacturing. Our most important goal is your satisfaction. At B & K, test equipment is made to meet the demands of the field focusing on dependability and accuracy. We also concentrate on simplicity and operating ease with features that reduce the possibility of human error and speed the servicing process.

In order to determine the type of test units that are needed we have been guided by letters and reports from technicians and engineers who use the equipment daily. Our field tests and studies have helped provide better and faster service techniques. Close contact has been maintained with the manufacturers of consumer products which our test units will be checking and trouble-shooting.

Key personnel in our company cut their eye teeth in the TV service business. This is why we have more "sensitivity" for the problems and conditions under which the test equipment will be used.

B & K product designs are constantly reviewed, and refinements are made or new models developed to meet advances in our industry and to fill your needs. We set our standards high so you can be assured that the B & K test instruments you buy represent advanced design, quality construction, and dependable long-term performance at a price you can afford.

If you have any comments or thoughts about our products, or test equipment in general, I would be delighted to hear from you.

Thanks for your confidence in B & K and we look forward to serving you for a long time to come.

Sincerely,

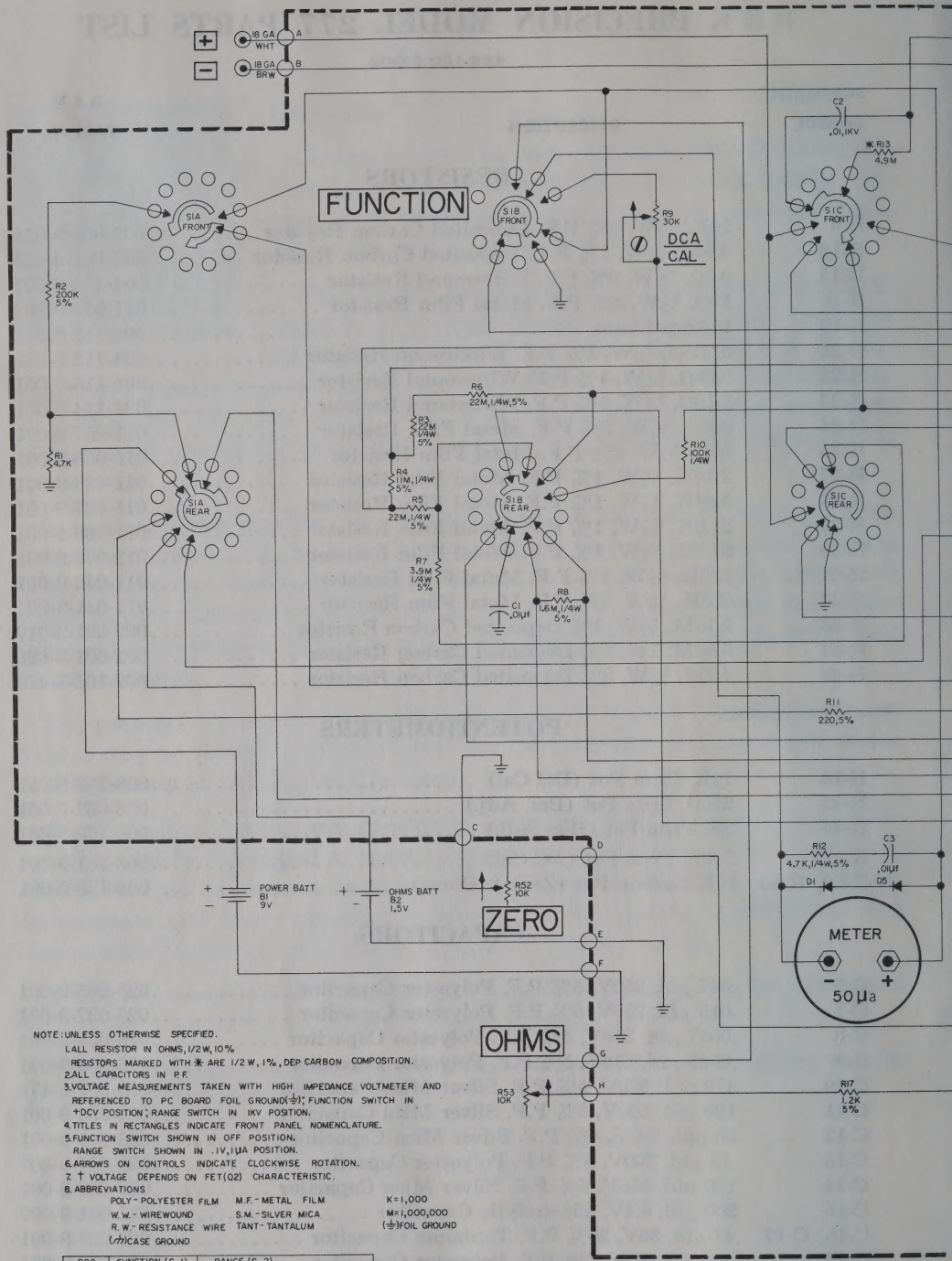
Carl Korn
President

B & K PRECISION MODEL 277 PARTS LIST

488-120-9-002

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.
	RESISTORS	
R-9	13K, ½W, 2% P.F. Deposited Carbon Resistor	002-001-9-034
R-13	4.9M, ½W, 1% P.F. Deposited Carbon Resistor	002-001-9-029
R-15	0.5Ω, ½W, 5% P.F. Wirewound Resistor	004-113-9-001
R-16	10Ω, ½W, 1% P.F. Metal Film Resistor	011-043-9-001
R-19	1 Amp Shunt	004-117-9-001
R-21	0.305Ω, ½W, 1% P.F. Wirewound Resistor	004-112-9-001
R-22	0.99Ω, ½W, 1% P.F. Wirewound Resistor	004-115-9-001
R-23	3.16Ω, ½W, 1% P.F. Wirewound Resistor	004-114-9-001
R-24	900Ω, ½W, 2% P.F. Metal Film Resistor	011-057-9-001
R-25	90Ω, ½W, 2% P.F. Metal Film Resistor	011-056-9-001
R-27	2.16K, ½W, 1% P.F. Metal Film Resistor	011-036-9-001
R-28	6.84K, ½W, 1% P.F. Metal Film Resistor	011-037-9-001
R-29	21.6K, ½W, 1% P.F. Metal Film Resistor	011-038-9-001
R-30	68.4K, ½W, 1% P.F. Metal Film Resistor	011-039-9-001
R-31	216K, ½W, 1% P.F. Metal Film Resistor	011-040-9-001
R-32	684K, ½W, 1% P.F. Metal Film Resistor	011-041-9-001
R-33	2.16M, ½W, 1% Deposited Carbon Resistor	002-001-9-019
R-34	6.84M, 1W, 1% Deposited Carbon Resistor	002-001-9-020
R-49	4.7M, ½W, 2% Deposited Carbon Resistor	002-102-3-475
	POTENTIOMETERS	
R-18	10K Trim Pot (DC Cal)	008-058-9-001
R-42	250Ω Trim Pot (Bal. Adj.)	008-067-9-001
R-44	2K Trim Pot (Bias Adj.)	008-170-9-001
R-47	200K Trim Pot (AC Cal)	008-181-9-001
R-52, R-53	10K Carbon Pot (Zero & Ohms)	008-183-9-001
	CAPACITORS	
C-6	.047 μfd, 250V, 5% P.F. Polyester Capacitor	025-065-9-001
C-7	.015 μfd, 250V, 5% P.F. Polyester Capacitor	025-037-9-001
C-8	.0047 μfd, 250V, 5% P.F. Polyester Capacitor	025-034-9-001
C-9	.0015 μfd, 650V, 5% P.F. Polyester Capacitor	025-035-9-001
C-10	470 pfd, 500V, 5% P.F. Silver Mica Capacitor	023-501-5-471
C-11	120 pfd, 500V, 5% P.F. Silver Mica Capacitor	023-036-9-001
C-12	56 pfd, 500V, 5% P.F. Silver Mica Capacitor	023-040-9-001
C-13	.15 μfd, 200V, 5% P.F. Polyester Capacitor	025-067-9-007
C-14	150 pfd, 500V, 5% P.F. Silver Mica Capacitor	023-039-9-001
C-15	200 μfd, 6.4V, Electrolytic Capacitor	022-001-9-007
C-16, C-17	.47 μfd, 35V, 20% P.F. Tantalum Capacitor	027-006-9-001
C-19	.33 μfd, 200V, 5% P.F. Polyester Capacitor	025-068-9-001

COMPOSITE
499-044-9-001



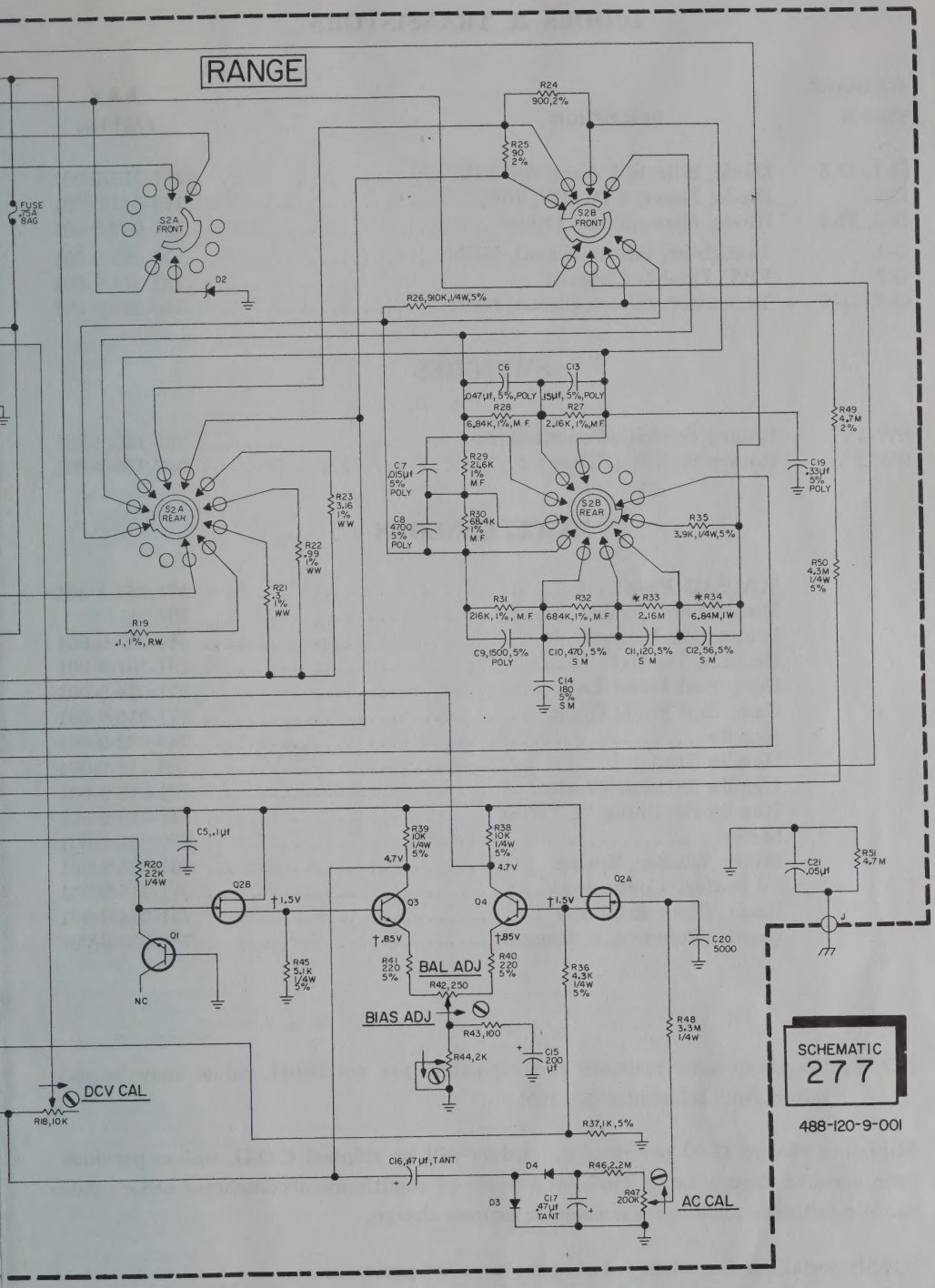
NOTE: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR IN OHMS, 1/2W, 10%
   RESISTORS MARKED WITH ✳ ARE 1/2 W, 1%, DEP CARBON COMPOSITION.
2. ALL CAPACITORS IN P.F.
3. VOLTAGE MEASUREMENTS TAKEN WITH HIGH IMPEDANCE VOLTMETER AND REFERENCED TO PC BOARD FOIL GROUND(⏚); FUNCTION SWITCH IN +DCV POSITION; RANGE SWITCH IN 1KV POSITION.
4. TITLES IN RECTANGLES INDICATE FRONT PANEL NOMENCLATURE.
5. FUNCTION SWITCH SHOWN IN OFF POSITION.
   RANGE SWITCH SHOWN IN .1V, 1µA POSITION.
6. ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION.
7. † VOLTAGE DEPENDS ON FET(Q2) CHARACTERISTIC.
8. ABBREVIATIONS

POLY - POLYESTER FILM
W.W. - WIREWOUND
R.W. - RESISTANCE WIRE
(///) CASE GROUND
M.F. - METAL FILM
S.M. - SILVER MICA
TANT - TANTALUM

K = 1,000
M = 1,000,000
(⏚) FOIL GROUND

POS	FUNCTION (S-1)	RANGE (S-2)
1	OFF/TRANSIT	.1V, 1µA, (.28V P-P)
2	BATT CHECK	.3V, 10µA, (.88V P-P)
3	-DVC	1V, 100µA, (2.8V P-P), RX1
4	+DVC	3V, 1mA, (8.8V P-P), RX10
5	ACV	10V, 10mA, (28V P-P), RX100
6	OHMS (HI)	30V, 30mA, (88V P-P), RX1K
7	OHMS (LO)	100V, 100mA, (280V P-P), RX10K
8	DCA	300V, 300mA (880V P-P), RX100K
9	———	1KV, 1A, (2.8KV P-P), RX1M


RANGE
FUSE 2A 8AG
S2A FRONT
D2
R24 900,2%
R25 90 2%
S2B FRONT
R26,910K,1/4W,5%
C6 .047µf, 5%, POLY
C13 .15µf, 5%, POLY
R28 6.84K, 1%, M.F.
R27 2.16K, 1%, M.F.
R49 4.7M 2%
C19 .33µf 5% POLY
R29 2.16K 1% M.F
C7 .015µf 5% POLY
C8 4700 5% POLY
R30 684K 1% M.F
S2A REAR
S2B REAR
R23 3.16 1% WW
R22 .99 1% WW
R21 1% WW
R19 .1, 1%, R.W.
R35 3.9K, 1/4W, 5%
R50 4.3M 1/4W 5%
R31 216K, 1%, M.F
R32 684K, 1%, M.F
R33
R34
2.16M
6.84M, 1W
C9, 1500, 5% POLY
C10, 470, 5% S M
C11, 120, 5% S M
C12, 56, 5% S M
C14 180 5% S M
C5, .1µf
R20 2.2K 1/4W
Q2B
Q1
NC
+1.5V
R45 5.1K 1/4W 5%
R39 10K 1/4W 5%
R38 10K 1/4W 5%
4.7V
Q3
Q4
Q2A
+1.5V
+.85V
+.85V
R41 220 5%
BAL ADJ
R42, 250
R40 220 5%
BIAS ADJ
R43, 100
R44, 2K
C15 200 µf
R36 4.3K 1/4W 5%
C20 5000
C21 .05µf
R51 4.7M
R48 3.3M 1/4W
DCV CAL
R18, 10K
R37, 1K, 5%
C16, 47µf, TANT
D4
R46, 2.2M
D3
C17 .47µf TANT
R47 200K
AC CAL
SCHEMATIC 277
488-120-9-001

DIODES & TRANSISTORS

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.
D-1, D-5	Diode, Silicon, 1 Amp, 600 PIV	151-018-9-001
D-2	Diode, Zener, 4.7V, 1W, 10%	152-043-9-001
D-3, D-4	Diode, Germanium, 1N695	150-007-9-001
Q-1	Transistor, Silicon Signal, NPN	176-023-9-001
Q-2	FET, Dual N Channel	182-024-9-001
Q-3, Q-4	Transistor, Silicon Signal, NPN	176-039-9-001

SWITCHES

SW-1	Rotary Switch (Function)	083-135-9-001
SW-2	Rotary Switch (Range)	083-136-9-001

MISCELLANEOUS

¾A, 8AG Fuse	191-251-8-304
Direct/100K Probe	PR-21
Instruction Manual	480-132-9-001
Bracket, Tie Bar	251-101-9-001
Case, End Panel Left	271-014-9-001
Case, End Panel Right	271-015-9-001
Handle	746-022-9-001
Handle Stud	763-018-9-001
Handle Friction Washer	731-013-9-001
Handle Retaining "E" Ring	741-049-9-001
Meter	320-041-9-001
Meter Washer, Spring	731-025-9-001
9V Battery Connector	771-015-9-001
Knob, (Zero & Ohms)	751-064-9-001
Knob, (Function & Range)	751-088-9-001

NOTE: Standard value resistors and capacitors are not listed, values may be obtained from schematic diagram.

Minimum charge $2.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express charge.

Specify serial number when ordering replacement parts.

RR-WERNER PRINTING

DYNASCAN CORPORATION

FACTORY AUTHORIZED PARTS AND SERVICE CENTERS

492-036-0-172

The following will handle any parts and/or service problems, either in or out of warranty. Your nearest service center has been selected for quality and prompt attention to your needs. Please take advantage of this service facility established for your benefit.

B & K Test Equipment (T) Cobra Communication Products (C) Precision (P)

ALABAMA

C Davidson's Communications
1103 Waverly Avenue
Muscle Shoals, Alabama 35660
AC 205 383-4222

C Statham TV Service
340 Killough Circle
Birmingham, Alabama 35215
AC 205 853-4530

ALASKA

C Rio Nova Electronics
1441 Laurene Street
P. O. Box 2624
Fairbanks, Alaska
AC 907 452-5958

ARIZONA

C Arizona Radio Communications
2717 E. McDowell
Phoenix, Arizona 85008
AC 602 274-5595

T Arizona Electric Standard Lab.
P 4428 North 19th Avenue
Phoenix, Arizona 85015
AC 602 264-9351

C Emmett Research Lab
1309 E. McDowell Road
Phoenix, Arizona 85006
AC 602 253-4783

ARKANSAS

C Prince Electronics
541 Quachita Avenue
Hot Springs, Arkansas 71901
AC 501 NA 4-2825

CALIFORNIA

C Electronic Service Company
T 7732 A Densmore Avenue
P Van Nuys, California 91406
AC 213 780-3071

C Guaranteed Electronics
T 5822 Mission Street
P San Francisco, California 94112
AC 415 DE 4-5900

T Hurley Electronics, Incorporated
2101 North Fairview
Santa Ana, California 92706
AC 714 638-7220

C Imtronix
T 305 North Broadway
AC 714 638-7220
Fresno, California 93701
AC 209 485-2741

C Imtronics
1635 "M" Street
Merced, California 95340
AC 209 723-2261

CALIFORNIA (Cont'd)

C Robert McQuade
Lakemont Pines Subdiv.
McKinzie Ave.
One Mile Below Arnold, Calif. 95223
(P.O. Box 215, Avery, Calif. 95224)
AC 209 795-2981

T Otto's Instrument Service
Ontario International Airport
Ontario, California 91761
AC 714 986-6624

C Whitmore & Company
T 10466 East Alondra Blvd.
P Bellflower, California 90706
AC 213 TO 7-5728 TO 6-8816

CANADA

C Atlas Electronics Limited
T 50 Wingold Avenue
P Toronto 19, Ontario, Canada
AC 416 781-6174

COLORADO

T Allstate Electronics Corp.
229 Vallejo
Denver, Colorado 80223
AC 303 744-2771

C Alpha Tronics, Inc.
14251 East Colfax
Aurora, Colorado 80010
AC 303 344-3484

C Briscoe Instrument Labs
T 8105 East Colfax
P Denver, Colorado 80220
AC 303 377-1167

C Clyde N. Still Electronics
T 2630 West Kiowa
P Colorado Springs, Colorado 80904
AC 303 633-8404

FLORIDA

C Commercial Electronics & Comm.
T 4853 58th Avenue North
St. Petersburg, Florida 33714
AC 813 525-8087

C Fowkes Electronics
T 1830 Fouraker Road
P Jacksonville, Florida 32205
AC 904 781-0574

C P.S.L. Electronics, Inc.
T 4860 N.W. 2nd Avenue
Miami, Florida 33127
AC 305 754-8801

C Superior Electronic Center
T 2010 Pine Terrace
P Sarasota, Florida 33581
AC 813 955-9300

GEORGIA

C Rodd Electronics
1645 East Albany Expressway
Albany, Georgia 31705
AC 912 435-1044

IDAHO

C **Ken Kline Company**
Star Route
Moyic Springs, Idaho 83845
AC 208 267-3209

C Royal Radio & TV Service
T 1922 E. 14th Street
Des Moines, Iowa 50316
AC 515 266-5315

C **TV Tuner Service**
T **118 Third Street West**
P **Twin Falls, Idaho 83301**
AC 208 733-5636 (P.O. Box 793)

ILLINOIS

C **Dynascan Corporation**
T **1801 W. Belle Plaine Avenue**
P **Chicago, Illinois 60613**
AC 312 327-7270

C **Put's Radio Sales**
737 East Marietta
Peoria Heights, Illinois 61614
AC 309 685-5271

INDIANA

T Turner Electronics
18 South New Jersey St.
Indianapolis, Indiana 46204
AC 317 639-9169

IOWA

C **Everts Electronics**
Post Office Box 350
128 3rd Street
Glidden, Iowa 51443
AC 712 659-3869

KANSAS

C **Electronics Specialists**
South Highway #283
Dodge City, Kansas 67801
AC 316 225-5881

T **Main Electronics, Inc.**
353 Pattie
Wichita, Kansas 67211
AC 316 267-3581

LOUISIANA

T **Audio & Instrument Associates**
P **5511 Sussex Street**
Shreveport, Louisiana 71108
AC 318 868-9577

C **Circle "D" Electronics**
206 Circle Drive
Post Office Box 4209
West Monroe, Louisiana 71201
AC 318 323-4732

C **Fisher Electronics Lab.**
T **8309 Apple**
P **New Orleans, Louisiana 70118**
AC 504 865-1380

C **Marshall F. Kelly Repair Service**
5738 Knoll Crest Street
Shreveport, Louisiana 71109
AC 318 631-4551

MARYLAND

C **Boyers Two-Way Radio**
5110 W. Howard Street
Hagerstown, Maryland 27140
AC 301 RE 3-6522

T **Meter Devices, Inc.**
11325 Maryland Avenue
Beltsville, Maryland 20705
AC 301 345-7775

MICHIGAN

C **Ajax Home Improvement Co.**
6530 Wyoming
Dearborn, Michigan 48128
AC 313 LU 4-9100

T Electro Instrument Repair
Div. Instrument Specialties, Inc.
1024 West 14 Mile Road
Clawson, Michigan 48017
AC 313 588-6688

C **Electronic Distributing, Inc.**
1960 Peck Street
Muskegon, Michigan 49441
AC 616 726-3196

C Main Electronics
T 5558 South Pennsylvania
P Lansing, Michigan 48910
AC 517 882-5035

C **Whightsil's Distributing Co.**
605 South Main Street
Ithaca, Michigan 48847
AC 517 875-3659

MINNESOTA

C **Morningside Communications**
Highway 75 South
Moorhead, Minnesota 56560
AC 218 233-3035

C Citizens Band Sales & Service
8345 12th Ave.
Minneapolis, Minn. 55420
AC 218 854-3774

MISSOURI

C **Bill's Two-Way Radio**
3214 South 169 Highway
St. Joseph, Missouri 64503
AC 816 279-1152

C Bob's Television Communications
Hiway 240, Route 4
Marshall, Missouri 65340
AC 816 886-8247

C **Communications & Elec. Sve.**
8905 Manchester
Post Office Box 11584
Kansas City, Missouri 64138
AC 816 763-2132

C Lectronic Service, Inc.
T 321 S. Main Street
Lee's Summit, Mo. 64063
Area Code 816 524-0777

C **Peterson Radio & TV**
910 Ildereen Drive
Springfield, Missouri 65804
AC 417 866-1261

C **Scherrer Instruments**
T **7170 Manchester Avenue**
P **St. Louis, Missouri 63143**
AC 314 644-5362

C **Kermit Shetley**
T **2613 Marvin**
Cape Girardeau, Missouri 63701
AC 314 ED 4-2044

MISSOURI (Cont'd)

C Westcon Electronics
8101 Troost Avenue
Kansas City, Missouri 64131
AC 816 333-0030

MONTANA

C Montana Precision Measurements
T 1021 Cook Avenue
Billings, Montana 59102
AC 406 245-3296

NEBRASKA

C **The CB Shop**
Nealrene Acres—Route 8
Lincoln, Nebraska 68516
AC 402 488-5803

C **Electronic Associates**
5125 Colfax
Lincoln, Nebraska 68504
AC 402 434-4655

C Randy's CB Center
6612 North 90th Street
Omaha, Nebraska 68134
AC 402 572-8905

NEVADA

T Neva Tronix Research
1928 Western Street
Las Vegas, Nevada 89102
AC 702 382-9639

NEW JERSEY

T Hosica Laboratories
P 715 Main Street
Singac, New Jersey 07424
AC 201 256-7724

C L & M Electronics
2005 Highway 35
Ocean, New Jersey 07712
AC 201 531-3727

C Simon Side Band Company
Holland Mountain Road
Oak Ridge, New Jersey 07438
AC 201 697-4246

C Cleon W. Taylor
Rte. 561 Haddonfield-Berlin Rd.
Gibbsboro, New Jersey 08026
AC 609 784-7447

NEW YORK

C Abco Communications Co.
550 Fourth Avenue
Brooklyn, New York 11215
AC 212 SO 8-0100

T Circle Tele-Tronics, Inc.
1008 Utica Avenue
Brooklyn, New York 11203
AC 212 345-5656

C Compton Industries
413 Commerce Road
Vestal, New York 13850
AC 607 729-9221

T Electrical Instrument Service
P 25 Dock Street
Mount Vernon, New York 13850
AC 914 699-9717

C Hirsch Sales Company
219 California Drive
Williamsville (Buffalo), N.Y. 14221
AC 716 632-1189

NEW YORK (Cont'd)

C Oliphant Electronics
146-22 Liberty Avenue
Jamaica, New York 11435
AC 212 OL 8-9041 JA 6-5994

C Purchase Radio
747 Main Street
Buffalo, New York 14203
AC 607 TL 4-2125

NORTH CAROLINA

C Electronic Service Center
772 N C 268 West
Elkin, North Carolina 28621
AC 919 835-5421

C Ship & Shore Communications
814 Greenhowe Drive
Wilmington, North Carolina 28401
AC 919 791-0828 (P.O. Box 492)

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C Ohio Browning Outlet
5044 South Main Street
Akron, Ohio 44319
AC 216 896-1902

C DeCulp Electronics
Eureka Star Route
Gallipolis, Ohio 45631
AC 614 446-1639

C Electronic Devices Company
Furlow Street
Millersburg, Ohio 44654
AC 216 674-6706

C Findlay Communications
229 North Main Street
Findlay, Ohio 45840
AC 419 422-0133

C Howard's Radio Communications
6 North Seltzer Street
Wapokoneta, Ohio 45895
AC 419 738-3224

C Popdavid Radio Service
T 1255 Shadyside SW
Canton, Ohio 44710
AC 216 452-2710

OKLAHOMA

C Robby's Two-Way Radio Company
T 9501 N.E. 10th Street
Oklahoma City, Oklahoma 73130
AC 405 732-8036

OREGON

C Electronic Wholesale Mart
T 631 Northeast Grand Avenue
Portland, Oregon 97232
AC 503 235-8373

PENNSYLVANIA

C Bennie's Communications
1612 Walnut Street
Berwick, Pa. 18603
AC 717 759-0795

Certified Calibration Labs
T 2709 N. Broad Street
P Philadelphia, Pennsylvania 19132
AC 215 229-7557

C Meridian Electronics
333 Meridian Road
Butler, Pa. 16001
AC 412 482-2575

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C **Mobile Radio Repair**
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AC 215 273-3313

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Reading, Pennsylvania 19601
AC 215 374-6152 - 6741

C Adams County Electronics
Lincoln-Way—East
New Oxford, Penn. 17350
AC 717 624-7103

C **R. W. Trautman Comm.**
1071 S. King Street
Palmyra, Pa. 17078
AC 717 838-4153

C **James A. Weaver**
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Perkiomerville, Pa. 18074
AC 215 287-9786 or 234-8874

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C **Radio Labs**
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Charleston, South Carolina 29403
AC 803 722-9813

SOUTH DAKOTA

C Gunderson Radio & Television
161 Fifth Street Northeast
Watertown, South Dakota 57201
AC 605 886-3439

TENNESSEE

T **Edwin Bohr Electronics**
P **5880 Dayton Blvd.**
Chattanooga, Tenn. 37415
AC 615 877-8207

C **Russ Hellen's CB Center**
1027 Brooks
Memphis, Tennessee 38116
AC 901 396-6666

C **Powell Electronics**
6101 Wellworth Avenue
Chattanooga, Tennessee 37412
AC 615 698-3551

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C **L. Dale Andrews**
3830 Colina Lane
Waco, Texas 76705
AC 817 754-8130

C Industrial Radio Corporation
1318 Brazos
San Antonio, Texas 78207
AC 512 736-3119

C **Martin Electronics**
112 S. 17th St.
Nederland, Texas 77627
AC 713 772-8948

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C **Mitee TV Service**
T **3819 Mangum Road**
Houston, Texas 77018
AC 713 OV 2-7095

C **Permian Electronics**
2210 W. New Jersey
Midland, Texas 79701
AC 915 682-5011

T Whitlock Instrument
1306 North Texas Street
Odessa, Texas 79762
AC 915 337-3412

UTAH

T Salt Lake Instrument
1479 South Main Street
Salt Lake City, Utah 84115
AC 801 487-2541

VIRGINIA

T E.I.L. Instruments
P Division of Unitec Industries
121 Annondale
Falls Church, Virginia 22046
AC 703 532-0166

C **Falls Church Electronics**
6926 N. Fairfax Drive
Arlington, Virginia 22213
AC 703 534-2131

C S & W Electronics, Incorporated
3113 North Quebec Street
Arlington, Virginia 22207
AC 703 522-3966

C **Seaboard Electronics**
1737 Virginia Beach Road
Virginia Beach, Virginia 23453
AC 703 428-0349

WASHINGTON

C **BCB Sales, Inc.**
P.O. Box 840—
1908 E. George Washington Way
Richland, Washington 99352
AC 509 945-5300

C **Citizens Band Service**
17714 15th Avenue, N.E.
Seattle, Washington 98155
AC 206 EM 4-6410

T **Eicher Richards Company**
2727 N.E. Blakeley Street
Seattle, Washington 98105
AC 206 LA 3-7888

C **HCJ Electronics**
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INSTRUCTION MANUAL

FOR

Model 277

SOLID STATE ELECTRONIC MULTIMETER

B & K *DIVISION OF DYNASCAN CORPORATION*
1801 West Belle Plaine Avenue
Chicago, Illinois 60613

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GENERAL DESCRIPTION AND SPECIAL FEATURES

The B & K Model 277 is a solid state FET input Electronic Multimeter ideally suited for radio and TV service technicians industrial users, engineers and hobbyists.

Its main features include:

- High input Impedance on both a-c and d-c voltage measurements for minimum circuit loading.
- Low voltage and normal voltage ohms tests for measuring resistances or for testing IC's, transistors, SCR's, etc. in or out-of-circuit.
- Low power drain (less than 2ma) for extended battery life, including a battery check test.
- Protection from accidental overloads to meter, FET's and other circuit elements.
- An adjustable handle; a nice feature for bench use.
- A mirrored scale meter which increases accuracy of measurements.

SPECIFICATIONS

DC VOLTS:	
9 Ranges:	.1, .3, 1, 3, 10, 30, 100, 300, 1000V full scale.
Accuracy:	±2% full scale.
Input Resistance:	15 Megohms, ±2%, including 100K isolating resistor in probe.
AC Rejection:	26db minimum @ 60Hz for 2% accuracy change.
AC VOLTS:	
9 RMS Ranges:	.1, .3, 1, 3, 10, 30, 100, 300, 1000V full scale.
9 Peak-to-Peak Ranges:	.28, .88, 2.8, 8.8, 28, 88, 280, 880, 2800V full scale.
Accuracy:	±3% full scale @ 60Hz.
Input Impedance:	10 megohms shunted by approximately 56pf at input jacks.
Frequency Response:	±.5db, 30Hz to 150KHz. Approx. 3db @ 450KHz.
OHMS MEASUREMENT:	
7 Low Voltage Ranges (68mv):	RX1, RX10, RX100, RX1K, RX10K, RX100K, RX1M.
7 Normal Voltage Ranges (1.5V):	RX1, RX10, RX100, RX1K, RX10K, RX100K, RX1M.
Midscale Reading:	10 ohms on RX1 Range.
Accuracy:	±3° of arc.

DC CURRENT:

9 Ranges:	1μa, 10μa, 100μa, 1ma, 10ma, 30ma, 100ma, 300ma, 1 amp full scale.
Accuracy:	$\pm$3% full scale.
Internal Voltage Drop:	At instrument input terminals— 100mv, all ranges. Thru input cable— 100mv on 1μa to 30ma ranges. 140mv to 203mv on 100ma to 1 Amp range.

DECIBEL (db):

9 Ranges:	-20 to $+60$.
Accuracy:	$\pm$3% of full scale.
Reference:	1mw into 600 ohms.

MULTIPLIER AND SHUNT RESISTORS:

1% Precision Type:	Frequency Compensated.

METER: 4½", 50μa, $\pm$2%.
DC zero center ranges.
Mirrored scale meter.

PROTECTION: Meter and FET input protected from overloads.
Circuit overload protection by fuse (.75 Amp), except 1 Amp range.

SEMICONDUCTORS:
(1) Dual N-Channel FET.
(3) NPN Transistors.
(2) Germanium Diodes.
(1) Silicon Diode, I Amp, 600 PIV.
(1) Zener Diode.

BATTERIES REQUIRED:
(1) NEDA 1604 (9 Volt).
(1) #950 "D" Cell (1½ Volt).

DIMENSIONS: 7¼" H. x 5$\frac{13}{16}$" W. x 3⅝" D.

WEIGHT: 2 lbs., 6 oz. (less batteries and probe assembly)

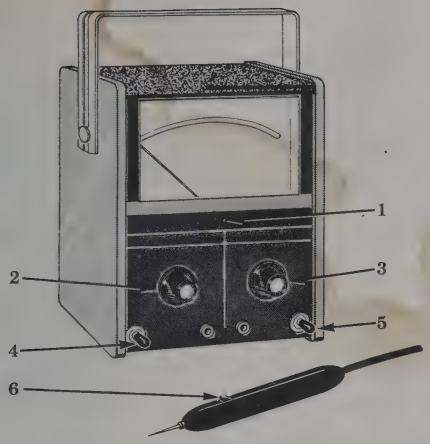


Figure 1. Operating Controls

OPERATING CONTROLS

The Model 277 Electronic Multimeter is as simple to operate as a standard VOM. The following is a brief description of each control and how it is used (Refer to Figure 1).

1. METER ZERO ADJUST (MECHANICAL): The mechanical zero adjustment must be made before the 277 is turned on. Insert a screwdriver (preferably non-metallic) into the slot located in the center of the front panel immediately below the meter face. While gently tapping meter, very slowly turn the mechanical zero-adjust counterclockwise until the pointer rests at zero.

2. FUNCTION SWITCH: The FUNCTION switch is used to turn the Model 277 on, to check the battery condition and to select the type of measurement to be performed. In the OFF position the meter is damped for protection in transit.

3. RANGE SWITCH: The RANGE switch selects the desired range of current, voltage, or resistance to be measured.

4. ZERO CONTROL: The ZERO control is used to position the pointer of the meter at zero on the meter scale or to position the pointer on the zero center when using this feature.

5. OHMS CONTROL: The OHMS control is adjusted with the test leads open. Rotate the OHMS control for a full scale indication, infinity (∞) on the ohms scale of the meter.

6. PROBE SWITCH: The Model 277 is equipped with a shielded test lead to allow accurate a-c measurements in the presence of strong electrical fields. When the switch is in the 100K position, a series 100K resistor is switched in series with the test lead. This isolates the cable capacity from the circuit under test when making d-c voltage measurements in r-f, i-f or sweep circuits. Set the probe switch to the DIRECT position for all measurements other than d-c voltage.

OPERATING THE MODEL 277

SAFETY PRECAUTIONS

A certain amount of danger is always present when working on electrical equipment and therefore, the user is cautioned to always familiarize himself as much as possible with the equipment to be tested, before any work is performed. It should be kept in mind that high voltages often appear at unexpected points in defective equipment.

When testing high voltage circuits, develop the habit of keeping one hand in your pocket to minimize the hazard of accidental shock. It is also important to have a properly insulated floor or floor covering to stand on while taking measurements. Be particularly careful to avoid contacting nearby objects which could provide a ground return path. A good practice is to remove operating power before connecting test leads. An isolation transformer should always be used in equipment having the chassis tied to one side of the a-c power line.

BATTERY INSTALLATION

To install or gain access to the batteries, remove the back from the 277. This is done simply by removing two (2) screws at the bottom and the two (2) screws at the rear near the top. After the screws have been removed, tilt the bottom part of the back outward (away from rear of unit) and then gently lift the back up and away from the top portion of the front panel.

NOTE

The battery holders are attached to the removable cover. Sufficient lead length is provided to allow the cover to lay flat when installing or replacing batteries. Be careful so as not to pull the cover away with excessive force. Both battery holders are now exposed for battery installation. Be sure to observe polarity on ohms battery ("D" cell) when installing.

After installing batteries, set FUNCTION switch to the BATT CHK position to check the 9 volt battery. Meter must indicate at or beyond BATT OK indication on meter scale. Set FUNCTION switch to HI OHMS and RANGE switch to the RX100K position. Rotate OHMS control to obtain an infinity (∞) indication on meter. Short test leads together and adjust zero control so meter reads zero. Unshort leads and check that the meter can be readjusted to infinity (∞) when rotating OHMS control. If batteries test satisfactorily, re-install back cover.

NOTE

To prolong battery life, always turn the unit OFF when not in use.

1. PREPARATION FOR MAKING MEASUREMENTS

a. With the FUNCTION switch in the OFF position, check to see that the meter pointer rests over the zero mark on the left side of the scale. If the

pointer is off zero, reset the meter zero adjust (mechanical) as explained under OPERATING CONTROLS.

b. Insert the double banana plug of the test lead assembly into the meter terminal receptacles so that the positive (+) pin of the plug is in the red (+) terminal of the meter.

c. Rotate the FUNCTION switch to the BATT CHK position, and observe the deflection of the meter pointer. As long as the pointer remains within the range of BATT OK indicated by red arrowhead on the upper part of the scale, the instrument accuracy is maintained.

2. MEASURING DC VOTAGES

a. Turn the FUNCTION switch to the −DC V or +DC V position, depending on the polarity of the voltage to be measured.

b. Set the PROBE switch to 100K.

c. When measuring an unknown voltage, set the RANGE switch fully clockwise.

d. Rotate ZERO control until meter pointer rests over zero mark on DC V/MA scale.

e. Connect the black (negative) lead of the test lead assembly to ground or reference point of the circuit under test. Bring the probe tip in contact with the point to be measured.

f. Observe the instrument reading; if the meter pointer deflects to the left, turn the FUNCTION switch to the correct polarity.

g. The d-c voltage is read on the two black scales just above the mirror on the meter. The top DC scale is used with the .1, 1, 10, 100, and 1,000 volt ranges. The second DC scale is used for the .3, 3, 30, and 300 volt ranges. The 0 to 1.0 volt scale is read directly for the 1.0 volt range, and is multiplied by .1, 10, 100, and 1,000 for the .1, 10, 100, and 1,000 volt ranges respectively. The 0 to 3.0 volt scale is read directly for the 3.0 volt range and multiplied by .1, 10, and 100 for the .3, 30 and 300 volt ranges respectively.

3. ZERO CENTER DC VOLTAGES

a. Set the FUNCTION switch at +DC V and short the test leads together.

b. Rotate the ZERO control knob clockwise until the meter pointer rests over the center zero mark (the bottom scale).

c. Set the RANGE selector switch to a range which is at least twice the probable voltage to be measured. Connect the test leads to the circuit the same as for d-c voltage measurement.

d. Observe the meter pointer indication on the black scale marked "0". Positive voltages will make the pointer deflect to the right of the center zero mark; negative voltages will make the pointer deflect to the left of the center zero mark. Each side of the scale represents one-half of the range being used.

For example, when the .1 volt range is being used, each half of the scale

represents .05 volt and each division .01 volt. The purpose for which the center zero scale is used is to indicate a balanced condition. For example, if the 277 is used in the alignment of an FM discriminator, the desired balanced condition will result in a reading of zero on the meter. A misaligned condition will cause some deflection in either the positive or negative direction.

4. MEASURING AC VOLTAGES (RMS & P-P)

NOTE

Effect of waveform in measuring AC voltages: The Model 277 employs a peak-to-peak type detector, and is calibrated using a sinusoidal signal. The scale is calibrated to give RMS readings, using effective values based on a true sine wave. When it is known that other than sinusoidal signals are being used, it must be recognized that the accuracy as specified for sinusoidal will not apply. However, peak-to-peak values will remain accurate.

a. Set the FUNCTION switch to AC V position.
b. Set the probe switch to DIRECT.
c. Set the RANGE switch to the desired range position. If the range is not known, set RANGE switch fully clockwise.
d. Short test leads together and rotate ZERO control until meter pointer rests over zero mark on AC V RMS scale.
e. Connect the black (negative) lead of the test lead assembly to the chassis or reference point of the circuit under test.
f. Bring the tip of the probe in contact with the point in the circuit where the voltage is to be measured.
g. Observe the meter indication. To measure RMS voltage, the two red scales marked AC V RMS are used. To measure peak-to-peak voltage, the two red scales marked AC V (P-P) are used. The scale readings are multiplied by the same multiplier factors as were used in d-c voltage measurements.

5. DB MEASUREMENTS

The DB scale (−15db to +2db) for measuring output level is calibrated according to the standard of 1mW into 600 ohms, and direct scale reading applies with RANGE switch at 1V position. The nine AC V ranges are in 10db steps, so that starting from "0db" on the 1V range, add 10db for each range above 1.0 volt and subtract 10 db for each range below 1.0 volt. DB measurements are a measure of the ratio between the power in the circuit under test, and the standard reference level indicated above. If the impedance across which the measurement is performed is other than 600 ohms, use Figure 2 to determine actual power level with respect to 600 ohm reference. The chart in Figure 3 can be used to determine the power being dissipated in a circuit if the circuit impedance along

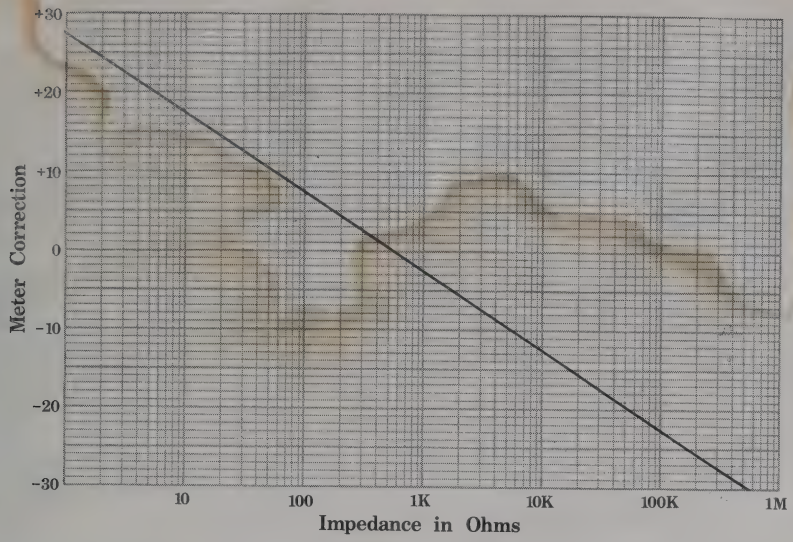


Figure 2. DB Correction Char

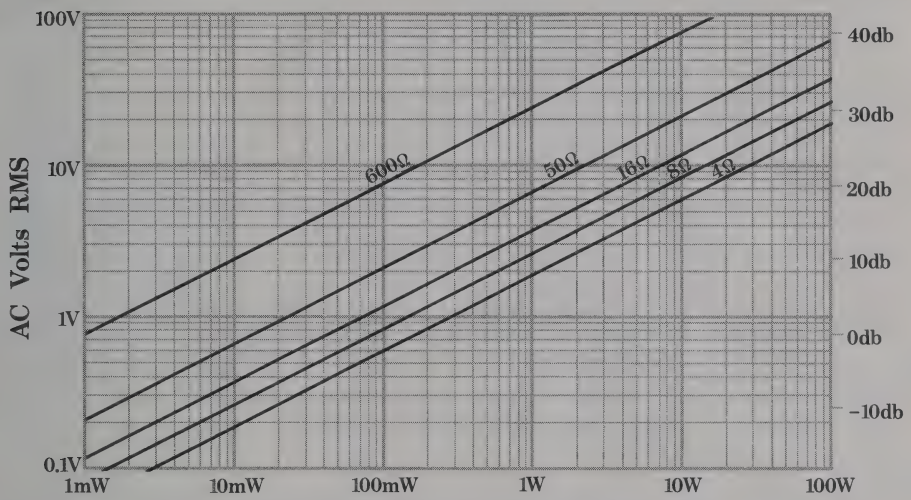


Figure 3. Voltage vs. Power Chart (Sine Wave Conditions Only)

with either the applied voltage, or the db is known. This chart also shows the relationship of AC volts to db.

NOTE

The db scales of the 277 and the charts in Figure 2 and Figure 3 only apply when the voltage being measured is a pure sine wave. Complex waveforms such as those encountered in music material will not give a true RMS reading for the db system to work on, but the db scales can be used for relative level measurements.

6. MEASURING RESISTANCES

CAUTION

When making resistance measurements be sure that the power to the equipment under test is disconnected. If voltage is accidentally applied to the ohms range, fuse replacement may become necessary.

A. HI OHMS MEASUREMENTS: To measure resistance, set the FUNCTION switch to the HI OHMS position, and the RANGE switch to the range that will put the resistance to be measured as close to the center of the meter scale as possible. When you switch the FUNCTION switch to the OHMS functions, the meter pointer will move from the left hand edge of the meter (Zero) to the infinity (∞) mark on the right hand side of the meter. Rotate the OHMS control to adjust the meter pointer to exactly the infinity mark on the right hand side of the meter.

When the meter leads are shorted together, the meter will indicate zero ohms on the left hand side of the meter. Be sure that the probe switch is in the DIRECT position. A resistance reading of approximately one ohm will be present on the RX1 range. This is the resistance of the switch contacts, ohms battery and internal wiring and should be subtracted from the resistance being measured on this range only.

When using the HI OHMS function in solid state circuits, the applied 1.5 volts from the 277 will be high enough to cause diodes or transistors to conduct. By reversing the meter leads, the front to back ratio of transistors or diodes can be measured. On all resistance ranges, the probe tip is positive with respect to the minus (−) test lead. Remember this when checking components which have a forward and reverse resistance such as semiconductors and electrolytic capacitors.

B. CHECKING FOR TRIGGERING OF LOW POWER SILICON CONTROLLED RECTIFIERS (SCR): Low Power SCR's can be checked to see if they can be triggered to the ON condition. To make this check, proceed as follows:

(1) Set your 277 to the HI OHMS function and the RANGE switch to RX1.
(2) Adjust OHMS control so meter reads full scale (∞).
(3) Set Probe switch to DIRECT position.
(4) Connect Minus (−) test lead to the cathode of the SCR and the Plus (+) test lead to the anode.
(5) If the SCR is good, meter will continue to read ∞. Now momentarily short gate lead to anode lead. Meter should read a very low resistance indicating that the SCR has been triggered and is conducting. Removing voltage from anode lead of SCR will return it to the non-conducting condition.

C. LOW OHMS MEASUREMENTS: The LO OHMS function is used to make resistance measurements in solid state circuits when the forward conduction of a diode or transistor junction can cause an objectionable error. When using this function, only 68 millivolts (.068 volt) is applied to the circuit being measured. This is below the conduction threshold of silicon and germanium semiconductor junctions.

The resistances measured with the 277 in the LO OHMS function will only be the resistance of the circuit components connected to the transistor or diode, and will not be affected by the transistor or diode.

IC's can be checked to see if they are shorted and also to measure resistance values within the IC.

NOTE

There is a continuous drain of approximately 6.8ma from the ohms battery in the LO OHMS position. To conserve ohms battery power, DO NOT LEAVE THE 277 IN THE LO OHMS POSITION WHEN NOT MAKING RESISTANCE MEASUREMENTS.

D. MEASURING RESISTANCE OF THERMISTORS: The LO OHMS function can be used for making accurate measurements of resistances of thermistors of low resistance value. If this measurement is made in the HI OHMS function, a changing resistance reading will result due to heating caused by the higher current flow through the thermistor. The thermistor should not be held in the hand and should be kept away from any other heat to obtain the most accurate resistance indication.

7. MEASURING DC CURRENT:

a. Set the FUNCTION switch to DC A.

b. Set the Probe switch to DIRECT position.

c. Short test leads together and rotate ZERO control until pointer rests over zero mark on DC V/MA scale.

d. Set the RANGE switch to the range desired. If the approximate value of current flowing within the circuit is not known, turn the RANGE switch to the 300mA position and work down toward the 1μa range until an accurate reading is obtained.

e. Open the circuit in which you wish to measure current flow. Connect the ground lead of the test lead assembly to the negative side of the circuit. Connect the tip of the probe to the positive side of the circuit under test.

f. Turn the power on in the circuit under test. Observe the meter pointer deflection. If the pointer is deflected to the left the current polarity is opposite of that which was anticipated. Turn off power, reverse the test lead and turn the power on again.

NOTE

The 1μa thru 300ma ranges are protected by an internal fuse. Use caution when using the 1 Amp range, since it is not fuse protected.

MAINTENANCE

The only normal maintenance required by the 277 is replacement of the batteries. This is described earlier in the manual under BATTERY INSTALLATION. The calibration, bias and balance adjustments have been made carefully and accurately at the factory, and should not require readjustment unless components have been replaced or adjustments have been disturbed. If, for any reason, recalibration becomes necessary, carefully perform the following procedures as required.

CALIBRATION OF THE 277 (SEE FIGURE 4 FOR ADJUSTMENT LOCATIONS): To gain access to the calibration adjustments it will be necessary to remove the back from the 277 (See BATTERY INSTALLATION for back removal instructions). These adjustments must be made in the order as indicated below.

(1) BIAS ADJUSTMENT: Connect an external voltmeter between + meter terminal on 277 and common ground (foil ground, −jack, etc.). Set the ZERO control so meter pointer rests over zero mark on DC V/MA scale. Adjust Bias adjusmtent so that external meter reads 4.7 volts.

(2) BALANCE: The balance control is set so that with the front panel zero control fully clockwise and the FUNCTION switch in the DC V position, the meter will indicate between .55 and .65 on the 0 to 1 volt scale. To adjust the balance control, set the RANGE switch to the 1KV range, set the FUNCTION switch to either DC volts position and turn the front panel zero control fully clockwise. Adjust the balance control until the meter indicates .6 on the 0 to 1 volt scale.

(3) DC VOLTS CALIBRATION: First check the setting of the mechanical and electrical zero adjustments. Set the RANGE switch to the .1V range, and the FUNCTION switch to the + DC V position. Set the Probe switch to the 100K position. Apply exactly .1 volt d-c to the input terminals and adjust DC Cal Pot for exactly a 1.0 indication on the 0 to 1 DC V/MA scale.

(4) AC VOLTS CALIBRATION: First check the setting of the mechanical and electrical zero adjustments. Set the RANGE switch to the .1V position, and the FUNCTION switch to the AC V position. Set the Probe switch to DIRECT position. Short test leads together and zero meter. Apply exactly a .1 volt RMS sine wave (60Hz to 1KHz) to the input terminals, and adjust AC Cal pot for exactly a 1.0 indication on the meter 0 to 1 AC V RMS scale. Calibration accuracy is dependent on accuracy of calibrating source.

REMOVING THE MODEL 277 FROM ITS CASE

To gain access to the printed circuit board and for general servicing, the case (end pieces) must be removed from the front panel.

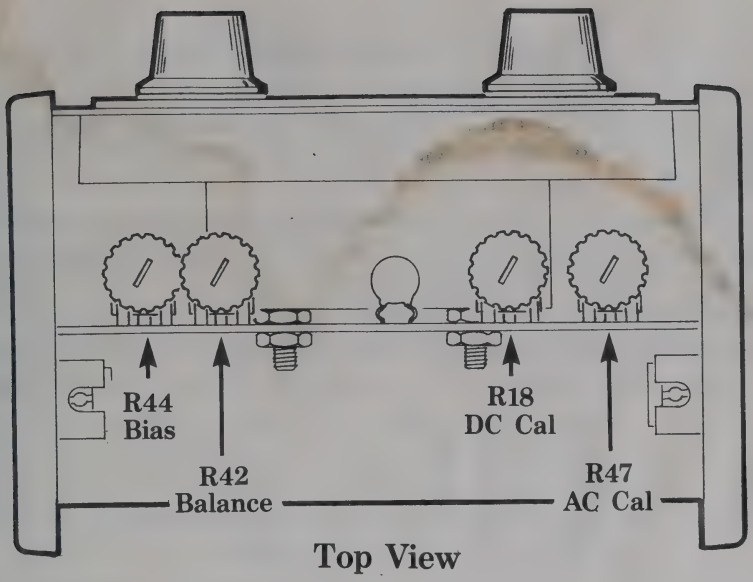


Figure 4. Adjustment Locations

To remove the case, first remove the back from the 277. See removal instructions under BATTERY INSTALLATION. Next, remove the two screws from the tie bar located at the top rear, just above the meter. Rotate the handle down toward the bottom rear of the 277. Gently pull end pieces outward (sideways) and away from front panel. Lift case (end pieces) up and away from front panel.

To remove the printed circuit board from the front panel, remove the two large control knobs and control nuts on the front panel. Sufficient lead length is provided to allow servicing of P.C. board.

The meter may be removed by taking out the meter mounting nuts that tie and connect the meter to the printed circuit board. Be sure to properly replace special contacting washers between PC Board and meter mounting nuts when reassembling.

OVERLOAD PROTECTION: The 277 is protected against accidental overloads on all functions and all ranges except the 1A range. The voltage ranges are protected because the high input impedance of the 277 limits the amount of voltage and current to the gate of the FET. On the resistance and current functions, the fuse F1 protects both the meter movement and the circuitry. This fuse should be replaced with one of the same type so that the protection feature or accuracy are not affected. Meter protection is provided by a silicon diode across its terminals.

CIRCUIT DESCRIPTION

The Model 277 Electronic Multimeter uses a balanced bridge impedance converter consisting of a dual field effect transistor and two (2) bi-polar transistors. This circuitry provides high input impedance and excellent stability.

When making d-c voltage measurements the d-c voltage is applied to the voltage divider (R27 through R34). The RANGE switch S28 selects the required input voltage to be applied to the input gate of Q2A. The FET Q2A provides the necessary high input impedance, and drives the base of Q3.

Q3 and Q4 operate as a stable differential amplifier with the meter connected between the collectors. The base of Q3 is driven by Q2A for d-c volts, ohms, and for current measurements. The base of Q4 (the 2nd half of the differential pair) is driven by Q2B for a-c voltage measurements. This half of Q2 is in turn driven by the peak-to-peak detector, D3 and D4. In the d-c volts, ohms, and current functions, the peak-to-peak detector does not receive a signal from Q2A because of the a-c rejection filter R13 and C1.

The dual FET is independent of temperature effects because it is in a small T0-71 package and very little temperature differential can exist between sections.

In the resistance measurement function, a standard resistor is placed in series with either a 68mv or 1.5 volt source and the voltage is applied to the gate of Q2A. The meter will read up scale with this arrangement and the OHMS control allows adjustment at exactly full scale (∞). If the test leads are shorted together, the gate of Q2A will be shorted to ground and therefore receive no voltage. The meter then reads zero ohms. If a resistor between zero ohms and infinite resistance is placed between the test leads, the gate will receive a voltage proportional to the resistor ratios (internal standard and measured resistor) and the meter will indicate the resistance on the Ohms scale. If the resistance being measured is equal to the standard internal resistance of the 277, one half of the voltage will be applied to the gate and the meter will read half scale. Voltage for the HI OHMS function is obtained from the 1.5 volt battery and is divided down before application to the gate of Q2A.

The 68 millivolts for the LO OHMS function is developed across a voltage divider R11, R15, and R16, and applied directly to the gate of Q2A thru a standard resistor. With more IC's and transistors being used everyday the LO OHMS function of the 277 is a must for making resistance measurements in solid state circuits.

When making a-c measurements the a-c rejection filter is switched out and AC is applied to the same divider as is used for d-c voltage measurements. However, capacitors across the divider now provide frequency compensation on all ranges. Therefore all frequencies between approximately 30Hz and 100Hz are attenuated equally in this divider when switching

ranges. The differential amplifier provides a-c gain and the peak-to-peak detector develops a negative voltage dependent on the peak positive and the negative voltage swing of the input voltage fed to it. The gate of Q2B receives the detected signal, applies it to Q4 which in turn drives the meter.

When measuring d-c current, a standard resistor is selected by the RANGE switch and put in series with the circuit to be measured. The voltage across the standard resistor is then measured and read as current on the meter. The fuse F1 protects resistors R16, R24, and R25. Fuse protection is not required on high resistance value resistors. The meter movement itself is protected on all ranges because it is isolated thru the impedance converter and shunted with a diode.

WARRANTY SERVICE INSTRUCTIONS

1. Service information is available from the factory at the address shown below.

2. Defective parts removed from the unit which are within the warranty period should be sent to the factory prepaid with the model and serial numbers of product from which they were removed. Also, include the date your Model 466 was purchased. These parts will be exchanged at no charge.

3. If you are unable to correct a difficulty, pack the product securely (preferably double packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B&K authorized service agency.

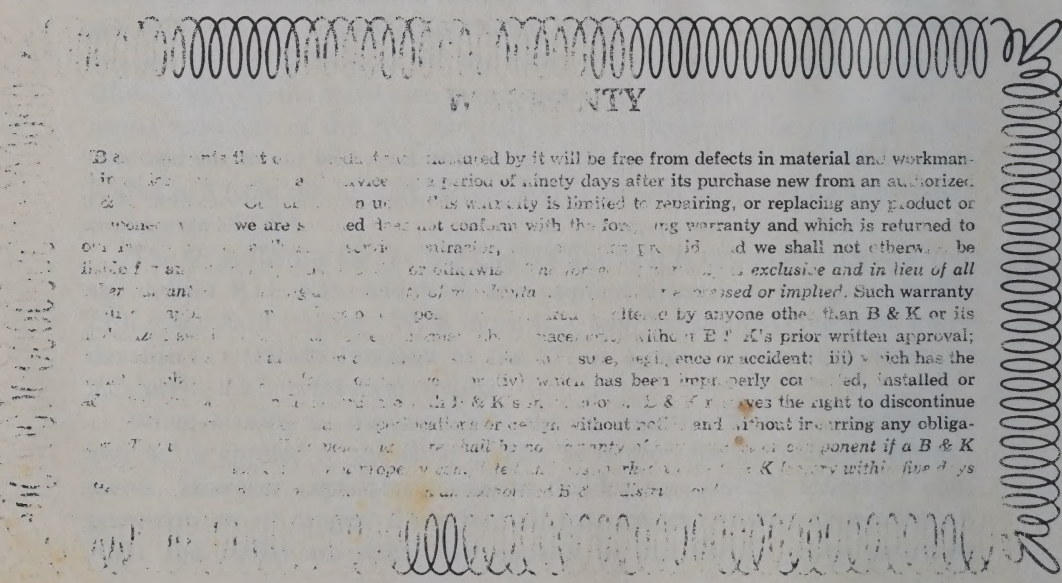
Contact your local B&K Distributor for the name and location of your nearest service agency, or write to

Service Department

B&K DIVISION OF DYNASCAN CORPORATION

1801 West Belle Plaine Avenue

Chicago, Illinois 60613



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B[illegible] ...ured by it will be free from defects in material and workman- ...ervice ... period of ninety days after its purchase new from an authorized ... ...n under this warranty is limited to repairing, or replacing any product or ... we are ...ed does not conform with the foregoing warranty and which is returned to ... ...ransportation, ... provided and we shall not otherwise be liable ... ...or otherwise ... *exclusive and in lieu of all ... expressed or implied.* Such warranty ... ...altered by anyone other than B & K or its ... ...without B & K's prior written approval; ... ...abuse, negligence or accident; (ii) which has the ... (iv) which has been improperly connected, installed or ... B & K's ... B & K reserves the right to discontinue ... ...specifications for design without notice and without incurring any obliga- ... ...shall be no warranty ... ...component if a B & K ... ...property with ... B & K factory within five days ... ...authorized B & K distributor.

WARRANTY

"B & K warrants that each product manufactured by it will be free from defects in material and workmanship under normal usage and service for a period of ninety days after delivery to the original purchaser from an authorized B & K distributor. Our obligation under this warranty is limited to repairing or replacing at our factory or our authorized service contractor, transportation prepaid, any product or component which we are satisfied does not conform with the foregoing warranty and which is returned to our factory or our authorized service contractor, transportation prepaid, and shall not otherwise be liable for any damages, consequential or otherwise. The foregoing warranty is exclusive and in lieu of all other warranties (including any warranty of merchantability), whether expressed or implied. Such warranty shall not apply to any product or component (i) repaired or altered by anyone other than B & K or its authorized service contractor (except normal tube replacement) without B & K's prior written approval, (ii) tampered with or altered in any way or subjected to misuse, negligence or accident, (iii) which has the serial number altered, defaced or removed; or (iv) which has been improperly connected, installed or adjusted otherwise than in accordance with B & K's instructions. B & K reserves the right to change any model at any time or change specifications or design without notice and without incurring any obligation. The warranty shall be void and there shall be no warranty of any product or component if a B & K warranty registration card is not properly completed and postmarked to the B & K factory within five days after the purchase of the product new from an authorized B & K distributor."

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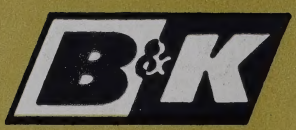

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